

# Advisory System for the Agricultural Tax Law

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**Abstract.** The authors of this study attempted to develop an advisory tool functioning in the scope of the Agricultural Tax Act. The focus of the authors in this study was on presenting the outcome of the efforts connected with building the ontology which would allow for representing individual cases. This study will also outline the structure and concept of the system in question.

**Keywords:** Legal expert system, agricultural tax law, ontology building

## 1 Introduction

The law regulating the life of man in society has become so complex that for the average person it is extremely difficult to understand its letter even when considered solely at the basic level of legal social functioning. Nowadays, the old Roman rule stipulating that the lack of legal knowledge cannot be the excuse to anyone sounds almost like a mockery. Therefore, an IT tool advising on certain legal acts could be very useful both to the average 'users' of law, as well as to the state administrative bodies

The authors of this study attempted to develop an advisory tool functioning in the scope of the Agricultural Tax Act [12]. The authors seek to create a tool which would provide the agricultural tax payers and officers with comprehensive advice in the scope of their rights and obligations. The choice of this Act was inspired by its specificity. The authors' primary emphasis was on the legal act being as deterministic as possible, as it would allow for considerably restricting the interpretation leeway which in the case of other legal acts is very wide. Another reason behind this choice stemmed from the fact that fiscal law calls for linguistic interpretation and utilisation of other ways of interpretation of law is not recommended (for example *a contrario*) or strictly forbidden (for example *per analogiam*). Legal acts of this kind significantly facilitate the development of advisory systems, reducing, though not fully eliminating, the impact of interpretation difficulties.

The Agricultural Tax Act governs such issues as tax calculation, tax rates, classification of taxpayers and farm land under various taxation classes, tax breaks and reliefs, payment conditions, land class changes, and the like. As the system is entirely based on the Polish statutory law, the Agricultural Tax Act, along with other

statutory provisions of a more detailed nature serves as the only source of knowledge. So far, there has been no need to refer to any other legal acts although general legal expertise has often proven imperative to properly construe individual provisions.

The focus of the authors in this study was on presenting the outcome of the efforts connected with building the ontology which would allow for representing individual cases, and dealing with cases not expressly regulated by law. This study will also outline the structure and concept of the system in question.

## **2 Legal Act**

Agricultural Tax Act [12] regulates the issues of agricultural tax calculation, maximum tax rates, classification of taxpayers and farm land under various taxation classes, tax breaks and reliefs, tax payment conditions, land class changes, and the like. As the system is entirely based on the Polish statutory law, the Agricultural Tax Act, along with other statutory provisions of a more detailed nature, serves as the only source of knowledge. So far, there has been no need to refer to any other legal acts although general legal expertise has often proven imperative to properly construe individual provisions.

Agriculture in Poland is not only one of these sectors of economy where the number of employees is still relatively high, but it is also very fragmented (with plenty of relatively small agricultural farms). Therefore, the number of agricultural tax payers is huge. As intended by the authors, the advisory tool, providing legal information on the rights and obligations of the agricultural tax payers, will come in handy not only for the taxpayers but also for the officers dealing with agricultural matters. It can facilitate and speed up the law interpreting process, cutting down the number of frauds.

## **3 System structure**

Rules are the major carrier of legal expertise in the system developed by the authors. However, unlike in the classic expert systems, they are “incorporated” into certain elements of ontology, which allows for a case to be described. The ontology thus forms an interpretation “background”. Particular instances of the ontology elements, i.e. input and output elements (conditions and conclusions) of the rules, make it possible to describe specific cases, and to introduce certain semantic aspect into the static knowledge (describing the reality). Apart from the classic legal rules, regulating changes to the legal status (e.g. deontic features), the system also contains more general rules which govern cases not expressly defined in the letter of law.

The JAVA language was selected as the system implementation tool, considering the ease it offers in representing and shaping such structures.

In turn, the PROLOG language was applied for pre-modelling the basic legal relations, especially those connected with the cases not expressly regulated by law. This choice was inspired by the huge possibilities in the scope of representing various logical relations, including the pretty complex ones, offered by PROLOG. Finally, the

full version of the system also makes use of the JBOSS RULES engine, highly flexible and compatible with JAVA. As the JBOSS RULES knowledge representation is rule-based, the model developed in PROLOG was extremely useful in creating the system. The JBOSS RULES engine is based on the RETE algorithm, and the authors believe that it is particularly predisposed to operate together with the JAVA-implemented ontology

The real-life situations were expressed as instances of individual classes. Part of the procedural knowledge (e.g. the mechanisms used for calculating conversion hectares) was defined in the class-specific methods.

## 4 Ontology

Any problem encountered by lawyers is highly specific, and this specificity must be properly accounted for to become interpretable in the context of the existing legal regulations. Several authors have made attempts to create more or less complex ontologies to represent legal acts [1, 2, 9, 13]. In consequence, the authors suggest the use of ontology for expressing the legal aspect of cases analysed. Further details concerning ontology can be found in [16]. It was implemented within the system as a structure comprising interfaces and classes, where an instant case is expressed through individual class instances. For example, if Mr. Bilbo Baggins is the owner of land in village Hobbiton, the description comprises the following class instances:

- Location (“The Hill”)
- Land (“Bag End”), class have attribute: Location. Value of the attribute: “The Hill”
- Village (“Hobbiton”) class has collection of attributes: Location. Value of the one of them: “The Hill”
- Natural Person (“Mr. Bilbo Baggins”)
- Ownership (“Ownership of Mr. Baggins”). Attribute: Owner, value: “Mr. Bilbo Baggins”, attribute property: “Bag End”

Naturally, each class consists of several attributes, some of which allow for making connections between individual instances. For example, “Location” is one of the attributes of the *Land* class instance, and the *Location* class instance serves as its value.

## 5 Deontic logic

When analyzing legal interpretation, it is hardly possible to neglect deontic logic, defined as the field of logic which is concerned with the formal relation between the following deontic concepts—obligation, prohibition, and permission. Lawyers frequently apply these basic laws of deontic logic more or less intuitively. Some examples of implementations of deontic logic in legal expert systems were described

in [14]. These laws facilitate interpretation of the least complex cases not expressly regulated by law.

Deontic logic revolves around three principal concepts, namely the concept of *permit*, *prohibited* and *obligatory* (some authors advocate one additional concept—indifference, but this study will be confined to the three principal concepts mentioned) [15]. Implementation of one of the basic deontic rules, stating that any actions obligatory are also permitted, proved indispensable in this study. This was modelled using the PROLOG language:

```
permitted(Action, Performer) :- obligatory(Action,
    Performer), action(Action), person(Performer).
```

Other principles stating, inter alia, that any actions prohibited are neither permitted nor obligatory, and – on the contrary – that any actions permitted and obligatory are not prohibited, should result from the structure of the knowledge base of the system.

There is one more issue to be focused on as regards deontic logic. Namely, the proper choice of ontology makes it considerably easier and very often possible at all, to represent the reality in which a given act functions. However, at the same time, the maker of the system has to face the necessity to somehow adjust the deontic logic to the actual ontology. Generally, ontologies take the form of a hierarchical structure of beings, and the place of such concepts as obligation, prohibition, and permission in this structure is of key importance.

Assuming that action B constitutes a sub-group of action A, we may infer that:

- permission to do A also means permission to do B, unless separate provisions stipulate otherwise, i.e. that B is forbidden
- obligation to do A does not mean obligation to do B; for instance, we are obliged to pay taxes but we may not necessarily be obliged to pay the agricultural tax (provided that we do not conduct agricultural activity but we work, for instance, at university).
- a prohibition on A means a prohibition on B, unless separate provisions stipulate otherwise, i.e. that B is permitted.

## 6 Rules

Rules are the major carrier of conditional legal norms in the system. In authors' opinion these rules should mirror legal principles, avoiding free interpretation of the act, as much as it is possible. Interpretation principles and reasoning should be separated from general knowledge base. Example of one of the rules is presented below:

```
rule "tax payer - owner"
when
land : Land();
person : Person();
```

```
ownership : Ownerhip(who == person && what == land &&
taxPayer == false);
    not possessor : Possessor(what == owner.what);
    not rent : Rent(what == owner.what);
    not user : User( what == owner.what );

then
ownership.setTaxPayer(true);
update(owner);
end
```

The above rule states whether the owner of the land is an agricultural tax payer. The first three provisions in the conditional part of the rule state that there should be a person who owns an instance of the class Land. The next three conditions exclude situations which defeat the rule. There are no other possibilities of defeating this rule and theory of law forbids creating the new defeating conditions out of any ways of interpretation (especially out of analogy).

Conclusion of the above rule changes the state of value of the attribute TaxPayer from false into true.

## 7 Interpretation of cases not expressly regulated

The legal theory and practice has given rise to a wide array of methods to deal with cases not expressly regulated by law, some of which were used by the authors. Implementation of one of the basic deontic rules, stating that any actions obligatory are also permitted, received top priority. In general, deontic logic is connected with the rules of instrumental obligation, and prohibition, and permission. Of these three, the rule of instrumental permission was the only one to be considered relatively unquestionable, and thus was implemented. The authors further considered the possibility to apply the *a contrario* interpretation method. The problem of interpretation of cases not expressly regulated by law is discussed wider in [17]. The subject of deontic logic is widely discussed i.a. in [6, 10, 14] instrumental reasoning and *a contrario* is mentioned in [5, 6, 8].

## 8 Conclusions

Expert systems were among the first computer tools applied to support legal expertise. Given their specificity, they were mainly used in modelling the statute law rather than the common law. Following the initial enthusiasm, they became the object of vivid criticism. Critical judgements concerning the viability of rule-based systems as a tool supporting legal expertise usually focused on the difficulties related to representing unclear and exceptionally complex definitions or to converting some of the most

complicated relations into rules. This criticism is by no means groundless. However, it should be emphasised that the level of detail differs among specific legal acts, thereby requiring different ways of interpretation. In certain cases, the theory of law requires very strict precision and grammatical interpretation.

The authors of this study have attempted to develop an advisory tool functioning in the scope of the Agricultural Tax Act. The principal goal of this is to provide automatic legal advice. Implementation of certain mechanisms which allow for advising on cases not expressly regulated in law is what makes this project exceptional. The system comprises three levels of representation of legal knowledge: the level of ontology, level of procedural knowledge and the level of rules. The ontology developed by the authors to allow for representing specific cases serves as the basic representation level, making it possible to describe the strictly legal concepts, as well as the commonsense-based concepts.

Elements of ontology serve as the conditions and conclusions of the rules which form the dynamic part of legal knowledge stored in the system. Apart from the rules which directly reflect the provisions of the legal act, the system also comprises a range of rules of a more general nature. The latter mirror the principles of legal interpretation, including the basic rules of deontic logic, and the rule of instrumental permission.

The elements implemented so far include the ontology and part of the deontic legal principles. The system is well capable of providing correct answers to the cases which clearly fall within the scope of the knowledge already implemented, as well as to certain questions not expressly defined in the provisions.

Future works will focus on implementing further provisions and on developing the module supporting interpretation of cases not expressly regulated in law. The authors envision introducing a distinction between various rules, based i.e. on the results of studies [10, 11], and are also going to focus on the more formal representation of legal knowledge. This distinction would aim to expand and to crystallize the possibilities related to interpreting some of the cases not expressly regulated by law. The authors are also going to focus on representation of consistency constraints in a knowledge base.

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